sputum production, decreased appetite, and shortness of breath are enough to indicate a need for antibiotic therapy. Fever, leukocytosis, or a new infiltrate on a chest roentgenogram are even more imperative signals. Sedimentation rate and quantitative C reactive protein, measures of acute-phase reactants, are used by some as additional indicators for administering antibiotics. The typical antibiotic course is long—14 to 21 days. Some patients use antibiotics nearly continuously, sometimes administered by aerosol in those with substantial secretions. Antibiotic use is guided by sputum cultures: *Haemophilus influenzae, Staphylococcus aureus,* and, later in life, *Pseudomonas aeruginosa* are the usual pathogens. Many antibiotics have an accelerated half-life in these patients, and dosage has to be adjusted accordingly.

Postural drainage and percussion preceded by an inhaled β-agonist is traditionally recommended twice a day. Lung transplantation, with a 50% survival at 2 years, is considered for patients with end-stage lung disease.

Cystic fibrosis is a complex disease with numerous medical, psychiatric, and social consequences. For patients and their families, it means a lifetime of adjustments. Patients can be managed by individual physicians but should also be registered with a cystic fibrosis center for consultation and provision of otherwise unavailable services. Such centers are identified by the National Cystic Foundation (1-800-FIGHT CF) and in California by the State Genetically Handicapped Persons Program (916-654-0503) and California Children's Service (916-654-0499).

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REFERENCES

Fifth Annual North American Cystic Fibrosis Conference. Pediatr Pulmonol 1991; 6(suppl):1-329

Kopelman H: Cystic fibrosis: Gastrointestinal and nutritional aspects. Thorax 1991; 46:261-267

Mouton JW, Kerrebijn KF: Antibacterial therapy in cystic fibrosis. Med Clin North Am 1990; 74:837-850

Aerosolized Bronchodilators

BECAUSE OF DIRECT DELIVERY to the site of action, inhaled bronchodilators are rapidly effective even in small quantities and, hence, cause a minimum of systemic side effects. Whether bronchodilators are inhaled through a nebulizer, through a metered-dose inhaler (MDI) with or without spacer, or through a dry powder inhaler (DPI), only about 10% to 20% of the inhaled drug traverses the major barrier of the upper airways and is available for deposition on potentially beneficial spots in lower airways. When selecting a form of aerosol administration, physicians should weigh the advantages and disadvantages of each type.

Nebulizers are expensive, labor intensive, and inconvenient compared with MDIs and DPIs. Unusual bronchodilators such as the anticholinergic glycopyrrolate can be delivered only by nebulizer. The waste in nebulizers is in the loss of drug in tubing and apparatus. Though nebulizers have been widely used for years, adjustment of the major elements of operation including fill volume, operating pressure and flow, and length of time of nebulization is not well established; hence, nebulizers are frequently not used well. Though nebulizers are as efficient as MDIs, amounts of medication used and delivered are much greater, and, hence, the possibility of side effects from overdosage is much greater.

Because of their convenience of size and the availability of most major bronchodilators, MDIs are widely used. Appropriate technique requires the coordination of canister activation with slow inhalation and breath-holding. While most patients can learn this technique, some will require aids such as spacers. Because spacers are less convenient, alternatives such as breath-actuated devices may be useful.

Though some drugs are available in the dry powder inhaler format, its use is not common. Within several years, when freon propellants are no longer available, DPIs probably will be used more frequently. A possible advantage of the DPI is that it delivers a drug as efficiently as a nebulizer or MDI without requiring coordination between activation and inhalation. New DPIs deliver several doses of a drug without the inconvenience of reloading.

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REFERENCE

Zainudin BM, Biddiscombe M, Tolfree SEJ, Short M, Spiro SG: Comparison of bronchodilator responses and deposition patterns of salbutamol inhaled from a pressurized metered dose inhaler, as a dry powder, and as a nebulized solution. Thorax 1990; 45:469-473

Screening for Obstructive Sleep Apnea Using Pulse Oximetry

RECENT RESEARCH has indicated that obstructive sleep apnea is much more common than generally appreciated. The reported prevalence is 1% to 5% in unselected populations and even greater in selected populations such as habitual snorers (30% to 50%). It is also serious, with an 8- to 11-year mortality of about 30%, affecting individuals through associated disease and society through sleep disruption and its effects on job performance and driving. At present, the recommended diagnostic tool is nocturnal polysomnography, but the expense, inconvenience, and lack of general availability of this test have deprived patients of the benefit of treatment.

The appropriate screening tool for obstructive sleep apnea remains to be defined. A patient's history may be highly suggestive, but only that, in 60% to 70%—snoring, observed apneas, and obesity, particularly truncal, are the most predictive. Examination will rarely be specific, even the direct observation of sleep. Pulmonary function tests are also not helpful; the sawtooth pattern of the flow-volume curve has been discredited as a marker. The non-neurophysiologic elements of the polysomnogram have also been suggested, but the absence of airflow, the sine qua non of obstructive sleep apnea, is difficult to record easily. The electrocardiogram often shows a characteristic, repetitive tachycardia-bradycardia, a consequence of the repetitive apneas, but the presence of an autonomic neuropathy will mask this.

Pulse oximetry has been shown to be highly specific (100%) but, using current accepted criteria for abnormal desaturations (less than or equal to 4%), is not sufficiently sensitive (60% to 70%). Two recent studies have highlighted this. At present, therefore, the screening of populations by visual analysis of pulse oximetry traces alone will lead to an underestimate of the prevalence of obstructive sleep apnea. In selected populations where clinical suspicion exists—sleepy snorers, for example—a negative or indeterminate pulse oximetry trace may not obviate the need for further study. Because oximetry is so specific, however, a positive study may allow the physician to introduce therapy such as nasal continuous airway pressure, with an abolition of symptoms being the criterion for adequate treatment.